

10/573998

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SEQUENCE LISTING

<110> Bayer CropScience GmbH

<120> Plants with reduced activity of a Class 3 branching enzyme

<130> BCS 03-5004-PCT

<150> EP 03090325.62003

<151> 2003-09-30

<160> 6

<170> PatentIn version 3.1

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<212> DNA

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Met Leu Ser Leu Ser Asp
1 5
tca att cga att tct tca cca ttg agc gat tct cgt ctt agt ttt cta 164
Ser Ile Arg Ile Ser Ser Pro Leu Ser Asp Ser Arg Leu Ser Phe Leu
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Ser Gln Thr Gly Ser Arg Thr Ser Arg Gln Leu Lys Phe Val Arg Ser
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cgc cgg gct cga gtt tcg agg tgt aga tgc tca gca acg gag caa ccg 260
Arg Arg Ala Arg Val Ser Arg Cys Arg Cys Ser Ala Thr Glu Gln Pro
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cca ccg caa cga cgg aag caa cga ccg gag aag tac aaa cag tcg gag 308
Pro Pro Gln Arg Arg Lys Gln Arg Pro Glu Lys Tyr Lys Gln Ser Glu
55 60 65 70
gaa gag aaa gga atc gat cct gtt gga ttt ctc agc aaa tac ggc att 356
Glu Glu Lys Gly Ile Asp Pro Val Gly Phe Leu Ser Lys Tyr Gly Ile
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| 90 95 100 | |
| aag gac ttg aag gat gaa ata ttg act cgt cat ttc agt ctc aag gag | 452 |
| Lys Asp Leu Lys Asp Glu Ile Leu Thr Arg His Phe Ser Leu Lys Glu | |
| 105 110 115 | |
| atg tct act ggg tat gaa tta atg ggt atg cat cgc aac ata caa cat | 500 |
| Met Ser Thr Gly Tyr Glu Leu Met Gly Met His Arg Asn Ile Gln His | |
| 120 125 130 | |
| cga gtg gat ttc ttg gaa tgg gct cca ggt gct cgc tac tgt gct ctg | 548 |
| Arg Val Asp Phe Leu Glu Trp Ala Pro Gly Ala Arg Tyr Cys Ala Leu | |
| 135 140 145 150 | |
| att ggt gac ttc aat ggg tgg tca aca act ggt aac tgt gcc aga gag | 596 |
| Ile Gly Asp Phe Asn Gly Trp Ser Thr Thr Gly Asn Cys Ala Arg Glu | |
| 155 160 165 | |
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| Gly His Phe Gly His Asp Asp Tyr Gly Tyr Trp Phe Ile Ile Leu Glu | |
| 170 175 180 | |
| gat aaa tta cgt gaa gga gaa gaa cct gat aaa ttg tat ttt caa cag | 692 |
| Asp Lys Leu Arg Glu Gly Glu Glu Pro Asp Lys Leu Tyr Phe Gln Gln | |
| 185 190 195 | |
| tac aat tat gcg gag gac tat gat aaa ggt gac acg ggt att acc gtc | 740 |
| Tyr Asn Tyr Ala Glu Asp Tyr Asp Lys Gly Asp Thr Gly Ile Thr Val | |
| 200 205 210 | |
| gag gaa atc ttt aaa aaa gca aat gat gag tat tgg gaa cct gga gaa | 788 |
| Glu Glu Ile Phe Lys Lys Ala Asn Asp Glu Tyr Trp Glu Pro Gly Glu | |
| 215 220 225 230 | |
| gat cgc ttc att aaa tca cgt tat gag gtg gca gca aag tta tat gag | 836 |
| Asp Arg Phe Ile Lys Ser Arg Tyr Glu Val Ala Ala Lys Leu Tyr Glu | |
| 235 240 245 | |
| gaa atg ttc gga cca aat gga cct caa aca gaa gag gaa cta gaa gca | 884 |
| Glu Met Phe Gly Pro Asn Gly Pro Gln Thr Glu Glu Glu Leu Glu Ala | |
| 250 255 260 | |
| atg cct gat gca gct aca cga tac aaa act tgg aaa gag caa caa aaa | 932 |
| Met Pro Asp Ala Ala Thr Arg Tyr Lys Thr Trp Lys Glu Gln Gln Lys | |
| 265 270 275 | |
| aag gat ccg gca agc aat ttg cca tcg tat gat gtg gta gat agt gga | 980 |
| Lys Asp Pro Ala Ser Asn Leu Pro Ser Tyr Asp Val Val Asp Ser Gly | |
| 280 285 290 | |
| aaa gaa tat gat att tac aat att ata ggt gat cct gaa tcg ttt aag | 1028 |
| Lys Glu Tyr Asp Ile Tyr Asn Ile Ile Gly Asp Pro Glu Ser Phe Lys | |
| 295 300 305 310 | |
| aaa ttt cgt atg aaa cag cct cct att gct tac tgg tta gaa act aaa | 1076 |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Lys | Phe | Arg | Met | Lys | Gln | Pro | Pro | Ile | Ala | Tyr | Trp | Leu | Glu | Thr | Lys | |
| | | | | 315 | | | | | 320 | | | | | 325 | | |
| aag | gga | agg | aaa | ggc | tgg | tta | cag | aaa | tat | atg | cct | gct | tta | cct | cat | 1124 |
| Lys | Gly | Arg | Lys | Gly | Trp | Leu | Gln | Lys | Tyr | Met | Pro | Ala | Leu | Pro | His | |
| | | | 330 | | | | | 335 | | | | | 340 | | | |
| gga | agc | aaa | cac | agg | gtg | tat | ttt | aac | aca | cca | aat | ggg | cct | ctt | gaa | 1172 |
| Gly | Ser | Lys | His | Arg | Val | Tyr | Phe | Asn | Thr | Pro | Asn | Gly | Pro | Leu | Glu | |
| | | 345 | | | | | 350 | | | | | 355 | | | | |
| cga | gtt | cct | gcg | tgg | gcc | aat | ttt | gtc | att | cca | gat | gca | gac | ggg | atg | 1220 |
| Arg | Val | Pro | Ala | Trp | Ala | Asn | Phe | Val | Ile | Pro | Asp | Ala | Asp | Gly | Met | |
| | 360 | | | | | 365 | | | | | 370 | | | | | |
| gca | tta | gca | gtc | cat | tgg | gaa | cca | cct | cct | gaa | tat | gct | tat | aaa | tgg | 1268 |
| Ala | Leu | Ala | Val | His | Trp | Glu | Pro | Pro | Pro | Glu | Tyr | Ala | Tyr | Lys | Trp | |
| 375 | | | | | 380 | | | | | 385 | | | | | 390 | |
| aaa | cac | aag | cta | cca | gtc | aag | cct | aag | tcc | ttg | cgc | ata | tat | gaa | tgt | 1316 |
| Lys | His | Lys | Leu | Pro | Val | Lys | Pro | Lys | Ser | Leu | Arg | Ile | Tyr | Glu | Cys | |
| | | | 395 | | | | | | 400 | | | | | 405 | | |
| cat | gtt | ggc | atc | tct | ggc | cag | gaa | cca | aaa | gtt | tca | tct | ttc | aat | gat | 1364 |
| His | Val | Gly | Ile | Ser | Gly | Gln | Glu | Pro | Lys | Val | Ser | Ser | Phe | Asn | Asp | |
| | | | 410 | | | | | 415 | | | | | 420 | | | |
| ttt | att | agc | aag | gtc | ctt | ccg | cat | gta | aaa | gaa | gct | gga | tac | aat | gca | 1412 |
| Phe | Ile | Ser | Lys | Val | Leu | Pro | His | Val | Lys | Glu | Ala | Gly | Tyr | Asn | Ala | |
| | | 425 | | | | | 430 | | | | | 435 | | | | |
| acg | caa | att | att | gga | gtt | gtt | gag | cac | aag | gat | tat | ttc | act | gtt | gga | 1460 |
| Thr | Gln | Ile | Ile | Gly | Val | Val | Glu | His | Lys | Asp | Tyr | Phe | Thr | Val | Gly | |
| | 440 | | | | | 445 | | | | | 450 | | | | | |
| tat | aga | gtg | acc | aat | ttt | tat | gct | gtt | agt | agc | cgt | tat | ggc | aca | ccg | 1508 |
| Tyr | Arg | Val | Thr | Asn | Phe | Tyr | Ala | Val | Ser | Ser | Arg | Tyr | Gly | Thr | Pro | |
| 455 | | | | | 460 | | | | | 465 | | | | | 470 | |
| gat | gac | ttc | aag | cgc | ttg | gtt | gat | gaa | gca | cat | ggg | ctt | gga | ctg | ctt | 1556 |
| Asp | Asp | Phe | Lys | Arg | Leu | Val | Asp | Glu | Ala | His | Gly | Leu | Gly | Leu | Leu | |
| | | | 475 | | | | | | 480 | | | | 485 | | | |
| gtc | ttt | ttg | gag | att | gtg | cac | tcc | tat | gca | gca | gca | gat | gaa | atg | gtt | 1604 |
| Val | Phe | Leu | Glu | Ile | Val | His | Ser | Tyr | Ala | Ala | Ala | Asp | Glu | Met | Val | |
| | | | 490 | | | | | 495 | | | | | 500 | | | |
| ggg | tta | tct | ctt | ttt | gat | gga | gca | aat | gat | tgc | tat | ttc | cac | act | ggg | 1652 |
| Gly | Leu | Ser | Leu | Phe | Asp | Gly | Ala | Asn | Asp | Cys | Tyr | Phe | His | Thr | Gly | |
| | | 505 | | | | | 510 | | | | | 515 | | | | |
| aaa | cgt | gga | cac | cac | aaa | ttc | tgg | ggc | aca | cgg | atg | ttc | aaa | tat | gga | 1700 |
| Lys | Arg | Gly | His | His | Lys | Phe | Trp | Gly | Thr | Arg | Met | Phe | Lys | Tyr | Gly | |
| | 520 | | | | | 525 | | | | | 530 | | | | | |
| gat | cct | gat | gtt | ctg | cac | ttt | ctt | ctt | tca | aat | ctg | aac | tgg | tgg | gtg | 1748 |
| Asp | Pro | Asp | Val | Leu | His | Phe | Leu | Leu | Ser | Asn | Leu | Asn | Trp | Trp | Val | |

| 535 | 540 | 545 | 550 | |
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| gag gag tat cat gtc gat ggc ttc cat ttt cat tcg ctc tcg tcc atg | | | | 1796 |
| Glu Glu Tyr His Val Asp Gly Phe His Phe His Ser Leu Ser Ser Met | 555 | 560 | 565 | |
| ttg tat acg cat aat gga ttt gct tca ttt act ggt gac atg gat gaa | | | | 1844 |
| Leu Tyr Thr His Asn Gly Phe Ala Ser Phe Thr Gly Asp Met Asp Glu | 570 | 575 | 580 | |
| tac tgt aac caa tat gtt gac aag gag gcc tta ttg tac ctc ata tta | | | | 1892 |
| Tyr Cys Asn Gln Tyr Val Asp Lys Glu Ala Leu Leu Tyr Leu Ile Leu | 585 | 590 | 595 | |
| gca aat gaa gta tta cat gct ctt cat cct aat gtg atc acg att gct | | | | 1940 |
| Ala Asn Glu Val Leu His Ala Leu His Pro Asn Val Ile Thr Ile Ala | 600 | 605 | 610 | |
| gtg gat gca act ctg tat cct gga ctc tgc gat cca aca tct caa ggt | | | | 1988 |
| Val Asp Ala Thr Leu Tyr Pro Gly Leu Cys Asp Pro Thr Ser Gln Gly | 615 | 620 | 625 | 630 |
| gga ctg ggc ttt gat tat ttt gcc aat ctt tct gcc tca gag atg tgg | | | | 2036 |
| Gly Leu Gly Phe Asp Tyr Phe Ala Asn Leu Ser Ala Ser Glu Met Trp | 635 | 640 | 645 | |
| ctt gca tta ctt gaa aat act cct gat cat gaa tgg tgc atg agt aag | | | | 2084 |
| Leu Ala Leu Leu Glu Asn Thr Pro Asp His Glu Trp Cys Met Ser Lys | 650 | 655 | 660 | |
| att gtt agc aca tta gtg ggc gat aga caa aat act gat aaa atg ctt | | | | 2132 |
| Ile Val Ser Thr Leu Val Gly Asp Arg Gln Asn Thr Asp Lys Met Leu | 665 | 670 | 675 | |
| ttg tat gca gaa aat cac aac cag tcc att tct gga ggt cgt tcc ttc | | | | 2180 |
| Leu Tyr Ala Glu Asn His Asn Gln Ser Ile Ser Gly Gly Arg Ser Phe | 680 | 685 | 690 | |
| gca gaa ata ctg att ggt aac tcc ttg ggg aaa tct tcc ata tca caa | | | | 2228 |
| Ala Glu Ile Leu Ile Gly Asn Ser Leu Gly Lys Ser Ser Ile Ser Gln | 695 | 700 | 705 | 710 |
| gag tca tta ctt aga ggc tgc tcg tta cac aag atg atc aga tta att | | | | 2276 |
| Glu Ser Leu Leu Arg Gly Cys Ser Leu His Lys Met Ile Arg Leu Ile | 715 | 720 | 725 | |
| aca tct aca att ggt ggt cat gca tac ctc aac ttc atg ggc aat gaa | | | | 2324 |
| Thr Ser Thr Ile Gly Gly His Ala Tyr Leu Asn Phe Met Gly Asn Glu | 730 | 735 | 740 | |
| ttt ggt cac cca aag aga gta gag ttt cca atg tca agc aac aat ttc | | | | 2372 |
| Phe Gly His Pro Lys Arg Val Glu Phe Pro Met Ser Ser Asn Asn Phe | 745 | 750 | 755 | |
| tcc ttt tca ctg gct aac cgt cgc tgg gat cta ttg gaa gat gtt gta | | | | 2420 |
| Ser Phe Ser Leu Ala Asn Arg Arg Trp Asp Leu Leu Glu Asp Val Val | 760 | 765 | 770 | |

cat tat caa tta ttc tca ttt gat aag gat atg atg gac ttg gat aaa 2468
His Tyr Gln Leu Phe Ser Phe Asp Lys Asp Met Met Asp Leu Asp Lys
775 780 785 790

aat ggg aga att ttg tcc aga ggt ctt gcc aac att cac cat gtc aat 2516
Asn Gly Arg Ile Leu Ser Arg Gly Leu Ala Asn Ile His His Val Asn
795 800 805

gat act acc atg gtg att tct tac ttg aga ggt ccc aat ctc ttt gtg 2564
Asp Thr Thr Met Val Ile Ser Tyr Leu Arg Gly Pro Asn Leu Phe Val
810 815 820

ttc aac ttt cat cct gtc aat tca tat gaa aga tac att ata ggt gtg 2612
Phe Asn Phe His Pro Val Asn Ser Tyr Glu Arg Tyr Ile Ile Gly Val
825 830 835

gaa gaa gct gga gag tat caa gtc aca tta aat aca gat gaa aac aag 2660
Glu Glu Ala Gly Glu Tyr Gln Val Thr Leu Asn Thr Asp Glu Asn Lys
840 845 850

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Tyr Gly Gly Arg Gly Leu Leu Gly His Asp Gln Asn Thr Gln Arg Thr
855 860 865 870

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Ile Ser Arg Arg Ala Asp Gly Met Arg Phe Cys Leu Glu Val Pro Leu
875 880 885

cca agt aga agt gct cag gtc tac aag ttg acc cga att cta aga gca 2804
Pro Ser Arg Ser Ala Gln Val Tyr Lys Leu Thr Arg Ile Leu Arg Ala
890 895 900

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Leu Lys Phe Val Arg Ser Arg Arg Ala Arg Val Ser Arg Cys Arg Cys
35 40 45

Ser Ala Thr Glu Gln Pro Pro Pro Gln Arg Arg Lys Gln Arg Pro Glu
50 55 60

Lys Tyr Lys Gln Ser Glu Glu Lys Gly Ile Asp Pro Val Gly Phe
65 70 75 80

Leu Ser Lys Tyr Gly Ile Thr His Lys Ala Phe Ala Gln Phe Leu Arg
85 90 95

Glu Arg Tyr Lys Ser Leu Lys Asp Leu Lys Asp Glu Ile Leu Thr Arg
100 105 110

His Phe Ser Leu Lys Glu Met Ser Thr Gly Tyr Glu Leu Met Gly Met
115 120 125

His Arg Asn Ile Gln His Arg Val Asp Phe Leu Glu Trp Ala Pro Gly
130 135 140

Ala Arg Tyr Cys Ala Leu Ile Gly Asp Phe Asn Gly Trp Ser Thr Thr
145 150 155 160

Gly Asn Cys Ala Arg Glu Gly His Phe Gly His Asp Asp Tyr Gly Tyr
165 170 175

Trp Phe Ile Ile Leu Glu Asp Lys Leu Arg Glu Gly Glu Glu Pro Asp
180 185 190

Lys Leu Tyr Phe Gln Gln Tyr Asn Tyr Ala Glu Asp Tyr Asp Lys Gly
195 200 205

Asp Thr Gly Ile Thr Val Glu Glu Ile Phe Lys Lys Ala Asn Asp Glu
210 215 220

Tyr Trp Glu Pro Gly Glu Asp Arg Phe Ile Lys Ser Arg Tyr Glu Val
225 230 235 240

Ala Ala Lys Leu Tyr Glu Glu Met Phe Gly Pro Asn Gly Pro Gln Thr
 245 250 255

Glu Glu Glu Leu Glu Ala Met Pro Asp Ala Ala Thr Arg Tyr Lys Thr
 260 265 270

Trp Lys Glu Gln Gln Lys Lys Asp Pro Ala Ser Asn Leu Pro Ser Tyr
 275 280 285

Asp Val Val Asp Ser Gly Lys Glu Tyr Asp Ile Tyr Asn Ile Ile Gly
 290 295 300

Asp Pro Glu Ser Phe Lys Lys Phe Arg Met Lys Gln Pro Pro Ile Ala
 305 310 315 320

Tyr Trp Leu Glu Thr Lys Lys Gly Arg Lys Gly Trp Leu Gln Lys Tyr
 325 330 335

Met Pro Ala Leu Pro His Gly Ser Lys His Arg Val Tyr Phe Asn Thr
 340 345 350

Pro Asn Gly Pro Leu Glu Arg Val Pro Ala Trp Ala Asn Phe Val Ile
 355 360 365

Pro Asp Ala Asp Gly Met Ala Leu Ala Val His Trp Glu Pro Pro Pro
 370 375 380

Glu Tyr Ala Tyr Lys Trp Lys His Lys Leu Pro Val Lys Pro Lys Ser
 385 390 395 400

Leu Arg Ile Tyr Glu Cys His Val Gly Ile Ser Gly Gln Glu Pro Lys
 405 410 415

Val Ser Ser Phe Asn Asp Phe Ile Ser Lys Val Leu Pro His Val Lys
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Glu Ala Gly Tyr Asn Ala Thr Gln Ile Ile Gly Val Val Glu His Lys
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Asp Tyr Phe Thr Val Gly Tyr Arg Val Thr Asn Phe Tyr Ala Val Ser
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Ser Arg Tyr Gly Thr Pro Asp Asp Phe Lys Arg Leu Val Asp Glu Ala
 465 470 475 480

His Gly Leu Gly Leu Leu Val Phe Leu Glu Ile Val His Ser Tyr Ala
 485 490 495

Ala Ala Asp Glu Met Val Gly Leu Ser Leu Phe Asp Gly Ala Asn Asp
 500 505 510

Cys Tyr Phe His Thr Gly Lys Arg Gly His His Lys Phe Trp Gly Thr
 515 520 525

Arg Met Phe Lys Tyr Gly Asp Pro Asp Val Leu His Phe Leu Leu Ser
 530 535 540

Asn Leu Asn Trp Trp Val Glu Glu Tyr His Val Asp Gly Phe His Phe
 545 550 555 560

His Ser Leu Ser Ser Met Leu Tyr Thr His Asn Gly Phe Ala Ser Phe
 565 570 575

Thr Gly Asp Met Asp Glu Tyr Cys Asn Gln Tyr Val Asp Lys Glu Ala
 580 585 590

Leu Leu Tyr Leu Ile Leu Ala Asn Glu Val Leu His Ala Leu His Pro
 595 600 605

Asn Val Ile Thr Ile Ala Val Asp Ala Thr Leu Tyr Pro Gly Leu Cys
 610 615 620

Asp Pro Thr Ser Gln Gly Gly Leu Gly Phe Asp Tyr Phe Ala Asn Leu
 625 630 635 640

Ser Ala Ser Glu Met Trp Leu Ala Leu Leu Glu Asn Thr Pro Asp His
 645 650 655

Glu Trp Cys Met Ser Lys Ile Val Ser Thr Leu Val Gly Asp Arg Gln
 660 665 670

Asn Thr Asp Lys Met Leu Leu Tyr Ala Glu Asn His Asn Gln Ser Ile
 675 680 685

Ser Gly Gly Arg Ser Phe Ala Glu Ile Leu Ile Gly Asn Ser Leu Gly

| | | | | |
|---|-----|-----|-----|---------|
| 690 | | 695 | | 700 |
| Lys Ser Ser Ile Ser Gln Glu Ser Leu Leu Arg Gly Cys Ser Leu His | | | | |
| 705 | | 710 | | 715 720 |
| Lys Met Ile Arg Leu Ile Thr Ser Thr Ile Gly Gly His Ala Tyr Leu | | | | |
| | 725 | | 730 | 735 |
| Asn Phe Met Gly Asn Glu Phe Gly His Pro Lys Arg Val Glu Phe Pro | | | | |
| | 740 | | 745 | 750 |
| Met Ser Ser Asn Asn Phe Ser Phe Ser Leu Ala Asn Arg Arg Trp Asp | | | | |
| | 755 | | 760 | 765 |
| Leu Leu Glu Asp Val Val His Tyr Gln Leu Phe Ser Phe Asp Lys Asp | | | | |
| | 770 | | 775 | 780 |
| Met Met Asp Leu Asp Lys Asn Gly Arg Ile Leu Ser Arg Gly Leu Ala | | | | |
| 785 | | 790 | | 795 800 |
| Asn Ile His His Val Asn Asp Thr Thr Met Val Ile Ser Tyr Leu Arg | | | | |
| | 805 | | 810 | 815 |
| Gly Pro Asn Leu Phe Val Phe Asn Phe His Pro Val Asn Ser Tyr Glu | | | | |
| | 820 | | 825 | 830 |
| Arg Tyr Ile Ile Gly Val Glu Glu Ala Gly Glu Tyr Gln Val Thr Leu | | | | |
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| Asn Thr Asp Glu Asn Lys Tyr Gly Gly Arg Gly Leu Leu Gly His Asp | | | | |
| | 850 | | 855 | 860 |
| Gln Asn Thr Gln Arg Thr Ile Ser Arg Arg Ala Asp Gly Met Arg Phe | | | | |
| 865 | | 870 | | 875 880 |
| Cys Leu Glu Val Pro Leu Pro Ser Arg Ser Ala Gln Val Tyr Lys Leu | | | | |
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gat tct cgt ctt agt ttt cta tct caa acc gga agc aga acc agt cgc      97
Asp Ser Arg Leu Ser Phe Leu Ser Gln Thr Gly Ser Arg Thr Ser Arg
      20              25              30

cag ctt aaa ttt gtt cgc agc cgc cgg gct cga gtt tcg agg tgt aga     145
Gln Leu Lys Phe Val Arg Ser Arg Arg Ala Arg Val Ser Arg Cys Arg
      35              40              45

tgc tca gca acg gag caa ccg cca ccg caa cga cgg aag caa cga ccg     193
Cys Ser Ala Thr Glu Gln Pro Pro Pro Gln Arg Arg Lys Gln Arg Pro
      50              55              60

gag aag tac aaa cag tcg gag gaa ggg aaa gga atc gat cct gtt gga     241
Glu Lys Tyr Lys Gln Ser Glu Glu Gly Lys Gly Ile Asp Pro Val Gly
      65              70              75

ttt ctc agc aaa tac ggc att act cat aaa gcg ttt gct caa ttt ctt     289
Phe Leu Ser Lys Tyr Gly Ile Thr His Lys Ala Phe Ala Gln Phe Leu
      80              85              90              95

cgt gaa aga tat aaa tca ttg aag gac ttg aag gat gaa ata ttg act     337
Arg Glu Arg Tyr Lys Ser Leu Lys Asp Leu Lys Asp Glu Ile Leu Thr
      100             105             110

cgt cat ttc agt ctc aag gag atg tct act ggg tat gaa tta atg ggt     385
Arg His Phe Ser Leu Lys Glu Met Ser Thr Gly Tyr Glu Leu Met Gly
      115             120             125

atg cat cgc aac ata caa cat cga gtg gat ttc ttg gaa tgg gct cca     433
Met His Arg Asn Ile Gln His Arg Val Asp Phe Leu Glu Trp Ala Pro
      130             135             140

ggg gct cgc tac tgt gct ctg att ggt gac ttc aat ggg tgg tca aca     481
Gly Ala Arg Tyr Cys Ala Leu Ile Gly Asp Phe Asn Gly Trp Ser Thr
      145             150             155

act ggt aac tgt gcc aga gag ggt cat ttt ggt cat gac gat tat ggg     529
Thr Gly Asn Cys Ala Arg Glu Gly His Phe Gly His Asp Asp Tyr Gly
      160             165             170             175

tat tgg ttt att att ctt gaa gat aaa tta cgt gaa gga gaa gaa cct     577
Tyr Trp Phe Ile Ile Leu Glu Asp Lys Leu Arg Glu Gly Glu Glu Pro
      180             185             190

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| | |
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| gat aaa ttg tat ttt caa cag tac aat tat gcg gag gac tat ggt aaa | 625 |
| Asp Lys Leu Tyr Phe Gln Gln Tyr Asn Tyr Ala Glu Asp Tyr Gly Lys | |
| 195 200 205 | |
| ggt gac acg ggt att acc gtc gag gaa atc ttt aaa aaa gca aat gat | 673 |
| Gly Asp Thr Gly Ile Thr Val Glu Glu Ile Phe Lys Lys Ala Asn Asp | |
| 210 215 220 | |
| gag tat tgg gaa cct gga gaa gat cgc ttc att aaa tca cgt tat gag | 721 |
| Glu Tyr Trp Glu Pro Gly Glu Asp Arg Phe Ile Lys Ser Arg Tyr Glu | |
| 225 230 235 | |
| gtg gca gca aag tta tat gag gaa atg ttc gga cca aat gga cct caa | 769 |
| Val Ala Ala Lys Leu Tyr Glu Glu Met Phe Gly Pro Asn Gly Pro Gln | |
| 240 245 250 255 | |
| aca gaa gag gaa cta gaa gca atg cct gat gca gct aca cga tac aaa | 817 |
| Thr Glu Glu Glu Leu Glu Ala Met Pro Asp Ala Ala Thr Arg Tyr Lys | |
| 260 265 270 | |
| act tgg aaa gag caa caa aaa gag gat ccg gca agc aat ttg cca tcg | 865 |
| Thr Trp Lys Glu Gln Gln Lys Glu Asp Pro Ala Ser Asn Leu Pro Ser | |
| 275 280 285 | |
| tat gat gtg gta gat agt gga aaa gaa tat gat att tac aat att ata | 913 |
| Tyr Asp Val Val Asp Ser Gly Lys Glu Tyr Asp Ile Tyr Asn Ile Ile | |
| 290 295 300 | |
| ggt gat cct gaa tcg ttt aag aaa ttt cgt atg aaa cag cct cct att | 961 |
| Gly Asp Pro Glu Ser Phe Lys Lys Phe Arg Met Lys Gln Pro Pro Ile | |
| 305 310 315 | |
| gct tac tgg tta gaa act aaa aag gga agg aaa ggc tgg tta cag aaa | 1009 |
| Ala Tyr Trp Leu Glu Thr Lys Lys Gly Arg Lys Gly Trp Leu Gln Lys | |
| 320 325 330 335 | |
| tat atg cct gct tta cct cat gga agc aaa tac agg gtg tat ttt aac | 1057 |
| Tyr Met Pro Ala Leu Pro His Gly Ser Lys Tyr Arg Val Tyr Phe Asn | |
| 340 345 350 | |
| aca cca aat ggg cct ctt gaa cga gtt cct gcg tgg gcc aat ttt gtc | 1105 |
| Thr Pro Asn Gly Pro Leu Glu Arg Val Pro Ala Trp Ala Asn Phe Val | |
| 355 360 365 | |
| att cca gat gca ggc ggg atg gca tta gca gtc cat tgg gaa cca cct | 1153 |
| Ile Pro Asp Ala Gly Gly Met Ala Leu Ala Val His Trp Glu Pro Pro | |
| 370 375 380 | |
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| Pro Glu Tyr Ala Tyr Lys Trp Lys His Lys Leu Pro Val Lys Pro Lys | |
| 385 390 395 | |
| tcc ttg cgc ata tat gaa tgt cat gtt ggc atc tct ggc cag gaa cca | 1249 |
| Ser Leu Arg Ile Tyr Glu Cys His Val Gly Ile Ser Gly Gln Glu Pro | |
| 400 405 410 415 | |

| | |
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| aaa gtt tca tct ttc aat gat ttt att agc aag gtc ctt ccg cat gta | 1297 |
| Lys Val Ser Ser Phe Asn Asp Phe Ile Ser Lys Val Leu Pro His Val | |
| 420 425 430 | |
| aaa gaa gct gga tac aat gca ata caa att att gga gtt gtt gag cac | 1345 |
| Lys Glu Ala Gly Tyr Asn Ala Ile Gln Ile Ile Gly Val Val Glu His | |
| 435 440 445 | |
| aag gat tat ttc act gtt gga tat aga gtg acc aat ttt tat gct gtt | 1393 |
| Lys Asp Tyr Phe Thr Val Gly Tyr Arg Val Thr Asn Phe Tyr Ala Val | |
| 450 455 460 | |
| agt agc cgt tat ggc aca ccg gat gac ttc aag cgc ttg gtt gat gaa | 1441 |
| Ser Ser Arg Tyr Gly Thr Pro Asp Asp Phe Lys Arg Leu Val Asp Glu | |
| 465 470 475 | |
| gca cat ggg ctt gga ctg ctt gtc ttt ttg gag att gtg cac tct tat | 1489 |
| Ala His Gly Leu Gly Leu Leu Val Phe Leu Glu Ile Val His Ser Tyr | |
| 480 485 490 495 | |
| gca gca gca gat gaa atg gtt ggg tta tct ctt ttt gat gga gca aat | 1537 |
| Ala Ala Ala Asp Glu Met Val Gly Leu Ser Leu Phe Asp Gly Ala Asn | |
| 500 505 510 | |
| gat tgc tat ttc cac act ggt aaa cgt gga cac cac aaa ttc tgg ggc | 1585 |
| Asp Cys Tyr Phe His Thr Gly Lys Arg Gly His His Lys Phe Trp Gly | |
| 515 520 525 | |
| aca cgg atg ttc aaa tat gga gat ctt gat gtt ctg cac ttt ctt ctt | 1633 |
| Thr Arg Met Phe Lys Tyr Gly Asp Leu Asp Val Leu His Phe Leu Leu | |
| 530 535 540 | |
| tca aat ctg aac tgg tgg gtg gag gag tat cat gtc gat ggc ttc cat | 1681 |
| Ser Asn Leu Asn Trp Trp Val Glu Glu Tyr His Val Asp Gly Phe His | |
| 545 550 555 | |
| ttt cat tcg ctc tcg tcc atg ttg tat acg cat aat gga ttt gct tca | 1729 |
| Phe His Ser Leu Ser Ser Met Leu Tyr Thr His Asn Gly Phe Ala Ser | |
| 560 565 570 575 | |
| ttt act ggt gac atg gat gaa tac tgt aac caa tat gtt gac aag gag | 1777 |
| Phe Thr Gly Asp Met Asp Glu Tyr Cys Asn Gln Tyr Val Asp Lys Glu | |
| 580 585 590 | |
| gcc tta ttg tac ctc ata tta gca aat gaa gta tta cat gct ctt cat | 1825 |
| Ala Leu Leu Tyr Leu Ile Leu Ala Asn Glu Val Leu His Ala Leu His | |
| 595 600 605 | |
| cct aat gtg atc acg att gct gag gat gca act ctg tat cct gga ctc | 1873 |
| Pro Asn Val Ile Thr Ile Ala Glu Asp Ala Thr Leu Tyr Pro Gly Leu | |
| 610 615 620 | |
| tgc gat cca aca tct caa ggt gga ctg ggc ttt gat tat ttt gcc aat | 1921 |
| Cys Asp Pro Thr Ser Gln Gly Gly Leu Gly Phe Asp Tyr Phe Ala Asn | |
| 625 630 635 | |
| ctt tct gcc tca gag atg tgg ctt gca tta ctt gaa aat act cct gat | 1969 |

| | |
|---|------|
| Leu Ser Ala Ser Glu Met Trp Leu Ala Leu Leu Glu Asn Thr Pro Asp 640 645 650 655 | |
| cat gaa tgg tgc atg agt aag att gtt agc aca tta gtg ggc gat aga His Glu Trp Cys Met Ser Lys Ile Val Ser Thr Leu Val Gly Asp Arg 660 665 670 | 2017 |
| caa aat act gat aaa atg ctt ttg tat gca gaa aat cac aac cag tcc Gln Asn Thr Asp Lys Met Leu Leu Tyr Ala Glu Asn His Asn Gln Ser 675 680 685 | 2065 |
| att tct gga ggt cgt tcc ttc gca gaa ata ctg att ggt aac tcc ttg Ile Ser Gly Gly Arg Ser Phe Ala Glu Ile Leu Ile Gly Asn Ser Leu 690 695 700 | 2113 |
| ggg aaa tcc tcc ata tca caa gag tca tta ctt aga ggc tgc tcg tta Gly Lys Ser Ser Ile Ser Gln Glu Ser Leu Leu Arg Gly Cys Ser Leu 705 710 715 | 2161 |
| cac aag atg atc aga tta att aca tct aca att ggt ggt cat gca tac His Lys Met Ile Arg Leu Ile Thr Ser Thr Ile Gly Gly His Ala Tyr 720 725 730 735 | 2209 |
| ctc aac ttc atg ggc aat gaa ttt ggt cac cca aag aga gta gag ttt Leu Asn Phe Met Gly Asn Glu Phe Gly His Pro Lys Arg Val Glu Phe 740 745 750 | 2257 |
| cca atg tca agc aac aat ttc tcc ttt tca ctg gct aac cgt cgc tgg Pro Met Ser Ser Asn Asn Phe Ser Phe Ser Leu Ala Asn Arg Arg Trp 755 760 765 | 2305 |
| gat cta ttg gaa gat gtt gta cat tat caa ttg ttc tca ttt gat aag Asp Leu Leu Glu Asp Val Val His Tyr Gln Leu Phe Ser Phe Asp Lys 770 775 780 | 2353 |
| ggg atg atg gac ttg gat aaa aat ggg aga att ttg tcc aga ggt ctt Gly Met Met Asp Leu Asp Lys Asn Gly Arg Ile Leu Ser Arg Gly Leu 785 790 795 | 2401 |
| gcc aac att cac cat gtc aat gat act acc atg gtg att tct tac ttg Ala Asn Ile His His Val Asn Asp Thr Thr Met Val Ile Ser Tyr Leu 800 805 810 815 | 2449 |
| aga ggt ccc aat ctc ttt gtg ttc aac ttt cat cct gtc aat tca tat Arg Gly Pro Asn Leu Phe Val Phe Asn Phe His Pro Val Asn Ser Tyr 820 825 830 | 2497 |
| gaa aga tac att ata ggt gtg gaa gaa gct gga gag tat caa gtc aca Glu Arg Tyr Ile Ile Gly Val Glu Glu Ala Gly Glu Tyr Gln Val Thr 835 840 845 | 2545 |
| tta aat aca gat gaa aac aag tat ggt ggt aga gga cta ctt ggc cat Leu Asn Thr Asp Glu Asn Lys Tyr Gly Gly Arg Gly Leu Leu Gly His 850 855 860 | 2593 |
| gat cag aat att caa aga acc att agt aga aga gct gat gga atg aga Asp Gln Asn Ile Gln Arg Thr Ile Ser Arg Arg Ala Asp Gly Met Arg | 2641 |

| 865 | 870 | 875 | |
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| Phe Cys Leu Glu Val Pro Leu Pro Ser Arg Ser Ala Gln Val Tyr Lys | | | |
| 880 | 885 | 890 | 895 |
| ttg acc cga att cta aga gca tgatcactct agtaatcaaa gtgcctcata | | | 2740 |
| Leu Thr Arg Ile Leu Arg Ala | | | |
| | 900 | | |
| tgatgacaca aaaggaaagg ttctacattg cccttacact gatcaatatt gacacctttc | | | 2800 |
| cgagggtgagt ttctgtgatt cttgagcaga ctggttgcta gtcaattatc atgaactttt | | | 2860 |
| gccttcagca tccggatagt cgcttctcct gtgcaatgag ggcattggacg aatttttttt | | | 2920 |
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| | 20 | 25 | 30 |
| Leu Lys Phe Val Arg Ser Arg Arg Ala Arg Val Ser Arg Cys Arg Cys | | | |
| | 35 | 40 | 45 |
| Ser Ala Thr Glu Gln Pro Pro Pro Gln Arg Arg Lys Gln Arg Pro Glu | | | |
| | 50 | 55 | 60 |
| Lys Tyr Lys Gln Ser Glu Glu Gly Lys Gly Ile Asp Pro Val Gly Phe | | | |
| 65 | 70 | 75 | 80 |
| Leu Ser Lys Tyr Gly Ile Thr His Lys Ala Phe Ala Gln Phe Leu Arg | | | |
| | 85 | 90 | 95 |
| Glu Arg Tyr Lys Ser Leu Lys Asp Leu Lys Asp Glu Ile Leu Thr Arg | | | |
| | 100 | 105 | 110 |

His Phe Ser Leu Lys Glu Met Ser Thr Gly Tyr Glu Leu Met Gly Met
115 120 125

His Arg Asn Ile Gln His Arg Val Asp Phe Leu Glu Trp Ala Pro Gly
130 135 140

Ala Arg Tyr Cys Ala Leu Ile Gly Asp Phe Asn Gly Trp Ser Thr Thr
145 150 155 160

Gly Asn Cys Ala Arg Glu Gly His Phe Gly His Asp Asp Tyr Gly Tyr
165 170 175

Trp Phe Ile Ile Leu Glu Asp Lys Leu Arg Glu Gly Glu Glu Pro Asp
180 185 190

Lys Leu Tyr Phe Gln Gln Tyr Asn Tyr Ala Glu Asp Tyr Gly Lys Gly
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Asp Thr Gly Ile Thr Val Glu Glu Ile Phe Lys Lys Ala Asn Asp Glu
210 215 220

Tyr Trp Glu Pro Gly Glu Asp Arg Phe Ile Lys Ser Arg Tyr Glu Val
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Ala Ala Lys Leu Tyr Glu Glu Met Phe Gly Pro Asn Gly Pro Gln Thr
245 250 255

Glu Glu Glu Leu Glu Ala Met Pro Asp Ala Ala Thr Arg Tyr Lys Thr
260 265 270

Trp Lys Glu Gln Gln Lys Glu Asp Pro Ala Ser Asn Leu Pro Ser Tyr
275 280 285

Asp Val Val Asp Ser Gly Lys Glu Tyr Asp Ile Tyr Asn Ile Ile Gly
290 295 300

Asp Pro Glu Ser Phe Lys Lys Phe Arg Met Lys Gln Pro Pro Ile Ala
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Tyr Trp Leu Glu Thr Lys Lys Gly Arg Lys Gly Trp Leu Gln Lys Tyr
325 330 335

Met Pro Ala Leu Pro His Gly Ser Lys Tyr Arg Val Tyr Phe Asn Thr
 340 345 350

Pro Asn Gly Pro Leu Glu Arg Val Pro Ala Trp Ala Asn Phe Val Ile
 355 360 365

Pro Asp Ala Gly Gly Met Ala Leu Ala Val His Trp Glu Pro Pro Pro
 370 375 380

Glu Tyr Ala Tyr Lys Trp Lys His Lys Leu Pro Val Lys Pro Lys Ser
 385 390 395 400

Leu Arg Ile Tyr Glu Cys His Val Gly Ile Ser Gly Gln Glu Pro Lys
 405 410 415

Val Ser Ser Phe Asn Asp Phe Ile Ser Lys Val Leu Pro His Val Lys
 420 425 430

Glu Ala Gly Tyr Asn Ala Ile Gln Ile Ile Gly Val Val Glu His Lys
 435 440 445

Asp Tyr Phe Thr Val Gly Tyr Arg Val Thr Asn Phe Tyr Ala Val Ser
 450 455 460

Ser Arg Tyr Gly Thr Pro Asp Asp Phe Lys Arg Leu Val Asp Glu Ala
 465 470 475 480

His Gly Leu Gly Leu Leu Val Phe Leu Glu Ile Val His Ser Tyr Ala
 485 490 495

Ala Ala Asp Glu Met Val Gly Leu Ser Leu Phe Asp Gly Ala Asn Asp
 500 505 510

Cys Tyr Phe His Thr Gly Lys Arg Gly His His Lys Phe Trp Gly Thr
 515 520 525

Arg Met Phe Lys Tyr Gly Asp Leu Asp Val Leu His Phe Leu Leu Ser
 530 535 540

Asn Leu Asn Trp Trp Val Glu Glu Tyr His Val Asp Gly Phe His Phe
 545 550 555 560

His Ser Leu Ser Ser Met Leu Tyr Thr His Asn Gly Phe Ala Ser Phe

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 565 | | | | | | | | | | | | | | | | 570 | | | | | | | | | | | | | | | | 575 | | | | | | | | | | | | | | | |
| Thr | Gly | Asp | Met | Asp | Glu | Tyr | Cys | Asn | Gln | Tyr | Val | Asp | Lys | Glu | Ala | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 580 | | | | 585 | | | | | | 590 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leu | Leu | Tyr | Leu | Ile | Leu | Ala | Asn | Glu | Val | Leu | His | Ala | Leu | His | Pro | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 595 | | | | | 600 | | | | | | 605 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Asn | Val | Ile | Thr | Ile | Ala | Glu | Asp | Ala | Thr | Leu | Tyr | Pro | Gly | Leu | Cys | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 610 | | | | | 615 | | | | | 620 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Asp | Pro | Thr | Ser | Gln | Gly | Gly | Leu | Gly | Phe | Asp | Tyr | Phe | Ala | Asn | Leu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 625 | | | | 630 | | | | | | 635 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ser | Ala | Ser | Glu | Met | Trp | Leu | Ala | Leu | Leu | Glu | Asn | Thr | Pro | Asp | His | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 645 | | | | | 650 | | | | | | | | | 655 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Glu | Trp | Cys | Met | Ser | Lys | Ile | Val | Ser | Thr | Leu | Val | Gly | Asp | Arg | Gln | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 660 | | | | | 665 | | | | 670 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Asn | Thr | Asp | Lys | Met | Leu | Leu | Tyr | Ala | Glu | Asn | His | Asn | Gln | Ser | Ile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 675 | | | | | 680 | | | | | 685 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ser | Gly | Gly | Arg | Ser | Phe | Ala | Glu | Ile | Leu | Ile | Gly | Asn | Ser | Leu | Gly | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 690 | | | | | 695 | | | | | 700 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lys | Ser | Ser | Ile | Ser | Gln | Glu | Ser | Leu | Leu | Arg | Gly | Cys | Ser | Leu | His | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 705 | | | | 710 | | | | | 715 | | | | | | | | 720 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lys | Met | Ile | Arg | Leu | Ile | Thr | Ser | Thr | Ile | Gly | Gly | His | Ala | Tyr | Leu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 725 | | | | | 730 | | | | | | | | | 735 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Asn | Phe | Met | Gly | Asn | Glu | Phe | Gly | His | Pro | Lys | Arg | Val | Glu | Phe | Pro | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 740 | | | | | 745 | | | | | | | | 750 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Met | Ser | Ser | Asn | Asn | Phe | Ser | Phe | Ser | Leu | Ala | Asn | Arg | Arg | Trp | Asp | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 755 | | | | | 760 | | | | | 765 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leu | Leu | Glu | Asp | Val | Val | His | Tyr | Gln | Leu | Phe | Ser | Phe | Asp | Lys | Gly | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 770 | | | | | 775 | | | | | 780 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Met | Met | Asp | Leu | Asp | Lys | Asn | Gly | Arg | Ile | Leu | Ser | Arg | Gly | Leu | Ala | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 785 | | | | 790 | | | | | 795 | | | | | | | | 800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Asn Ile His His Val Asn Asp Thr Thr Met Val Ile Ser Tyr Leu Arg
805 810 815

Gly Pro Asn Leu Phe Val Phe Asn Phe His Pro Val Asn Ser Tyr Glu
820 825 830

Arg Tyr Ile Ile Gly Val Glu Glu Ala Gly Glu Tyr Gln Val Thr Leu
835 840 845

Asn Thr Asp Glu Asn Lys Tyr Gly Gly Arg Gly Leu Leu Gly His Asp
850 855 860

Gln Asn Ile Gln Arg Thr Ile Ser Arg Arg Ala Asp Gly Met Arg Phe
865 870 875 880

Cys Leu Glu Val Pro Leu Pro Ser Arg Ser Ala Gln Val Tyr Lys Leu
885 890 895

Thr Arg Ile Leu Arg Ala
900